

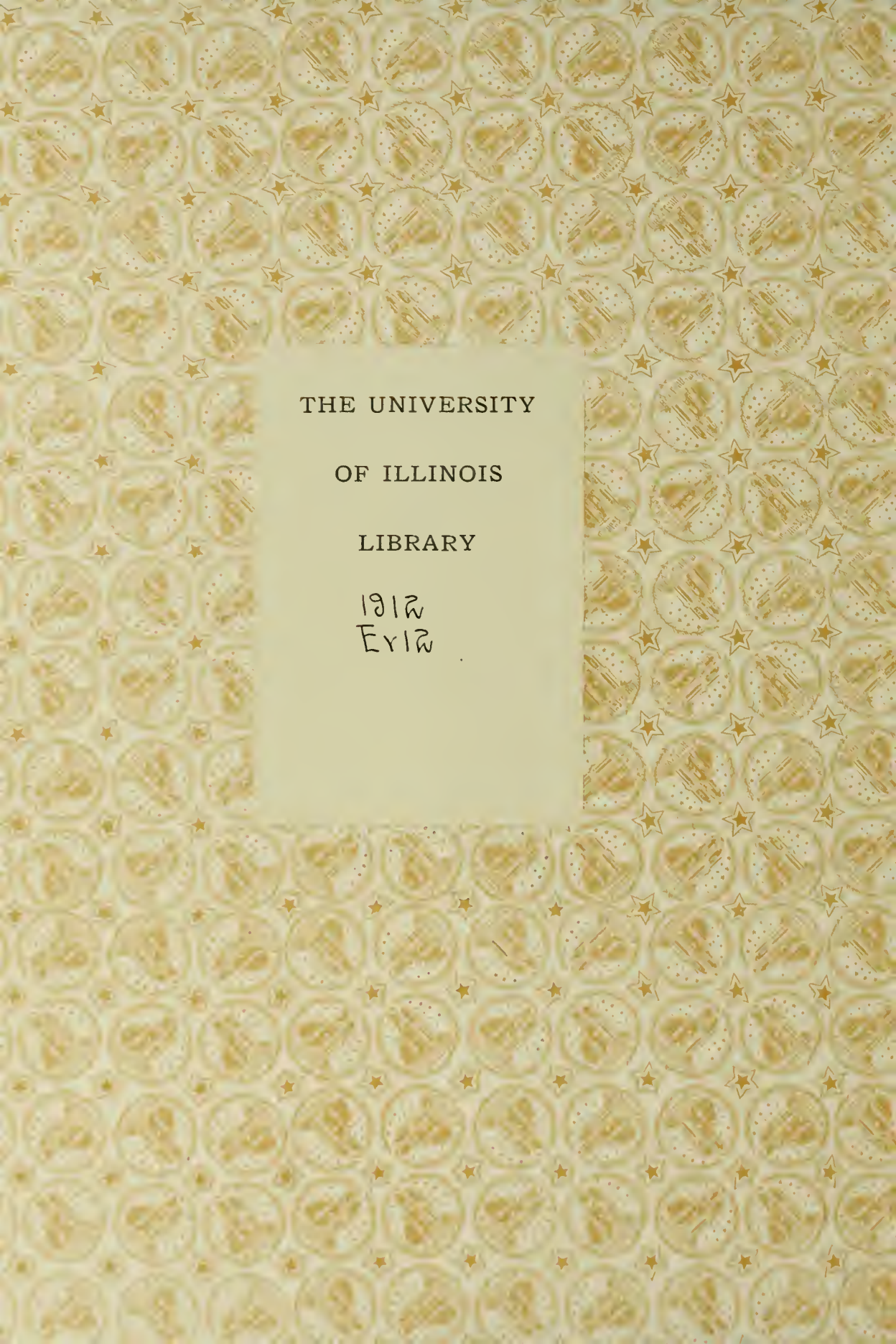
EVANS & SOTO

**Study in the Variation in the
Quality of the Steam in the Different
Stages of the Kerr Turbine**

Mechanical Engineering

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STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM
IN THE DIFFERENT STAGES OF THE KERR TURBINE

BY

JOHN EDWARD EVANS
AND
RAFAEL ARCANGEL SOTO

T H E S I S

FOR THE

DEGREE OF BACHELOR OF SCIENCE

IN

MECHANICAL ENGINEERING

COLLEGE OF ENGINEERING

UNIVERSITY OF ILLINOIS

1912

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

John Edward Evans and Rafael Arcangel Soto

ENTITLED Study in the Variation in the Quality of the Steam
in the Different Stages of the Kerr Turbine.

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

DEGREE OF Bachelor of Science in

Mechanical Engineering.

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Instructor in Charge


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I. INTRODUCTION.

In the case of the theoretical turbine steam expands adiabatically, i.e., no heat is added or rejected after it once enters the machine. Under these conditions we should have a definite quality at the end of the expansion or even in each stage. In the actual turbine such is not the case. The quality is bound to vary, due to the fact that the amount of heat in the steam is affected by the load applied, and by the friction and windage taking place in the nozzles and in the stages. These tests have been run therefore, to find out experimentally the effect of these factors upon the quality of the steam as it expands through the turbine.

II. OBJECT OF THESIS.

The object of this thesis is to determine the variation in the quality of the steam in the different stages of a 6-stage, 60 h.p., 18" Kerr turbine, with varying loads.

III. APPARATUS.

(a) Apparatus Tested.

The apparatus tested consisted of a 60 h.p. Kerr turbine with the following specifications:

Type of turbine -----	Multiple stage, velocity.
Maker-----	Kerr Turbine Co., Wellsville, N.Y.
Shop Number-----	21
Rated horse power -----	60
Steam pressure, lb. gage----	150
Rev. per min.-----	3600

Stage number	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Absolute pressure, lb. per sq. in.	110.7	74.3	49.8	33.4	22.4	15
Specific volume, cu. ft.	4.002	5.812	8.446	12.27	17.9	26.15
Total nozzle area, sq. in.	0.299	0.435	0.632	0.918	1.338	1.955
Number of nozzles.	6	10	14	20	24	20
Diameter of nozzles, in.	0.252	0.236	0.240	0.242	0.267	0.353
Size of buckets, in.	3/4	3/4	3/4	3/4	3/4	1 1/8
Number of buckets	84	84	84	84	84	68
Diameter of rotors, in.	18					
Diameter of shaft, in.	1 1/2					

(b) Testing Apparatus.

The following is a list of the testing apparatus used in connection with this thesis:

- 1---Prony brake attached to the turbine.
- 3---Carpenter's Separating Calorimeters, Serial Nos. 978, 163 and 695.
- 3---Cans to collect the condensate.
- 3---Scales to weigh the condensate.
- 8---Bourdon tube gages.

6 to measure pressure in stages:

	<u>Shop Number</u>	<u>Range</u>
First stage-----	577264	0-100
Second " -----	577265	-30-60
Third " -----	577266	-30-40
Fourth " -----	577267	-30-15
Fifth " -----	577268	-30-10
Sixth " -----	816N218	-30-15

	<u>Shop Number</u>	<u>Range</u>
1 to measure pressure below throttle	577263	0-180
1 to measure pressure in the main	816N206	0-200
1 throttling calorimeter with a 400° F. thermometer to find the quality in the main.		
speedcounter.		

The Prony brake was cooled in the following manner: water entered through a pipe into the inside of the brake pulley. From here it flowed outward, due to centrifugal force, through openings in the rim, passing up through holes into the top block and returning through additional holes. The rubbing surfaces of the blocks were grooved and lubrication was effected by means of soap dissolved in the water.

III. OPERATION OF THE TURBINE.

Steam enters through the throttle and governor valve under high pressure; then it passes through sets of fixed nozzles, and in so doing its pressure energy is transformed into kinetic energy. The jet from each of the nozzles impinges upon buckets set in the periphery of rotating disks, and these disks, being fast to the turbine shaft, impart their rotation to it. The action at each nozzle is similar to that in a Pelton water wheel.

The scheme of using six stages instead of one has for its purpose the reduction of the peripheral speed. This is accomplished by dividing the total pressure drop between the turbine inlet and the exhaust into six smaller pressure drops which take place in the different stages. The nozzles are so proportioned that the steam velocity is equal at each set of

nozzles. The way the division of the pressure drop is accomplished is as follows:- Steam issuing from the nozzles in the first stage, passes successively through the nozzles in the other stages. The pressure in each stage drops from a high to a lower value just before the jet impinges upon the buckets in the same stage. The drop in pressure causes a corresponding rise in velocity, and this rise of velocity is what produces the impulses upon the buckets of the wheel. This method of compounding is called pressure-compounding, and each drop in pressure constitutes a pressure stage.

IV. METHODS OF CONDUCTING THE TESTS.

The following steps were followed in getting the apparatus ready and in running the tests:

(a) Calibration of gages.

The Crosby gage tester was used in calibrating the high pressure gages, and the mercury column, with compressed air, in calibrating the low pressure gages. In this respect only the corrected readings are recorded.

(b) Preliminary Tests.

The turbine was rated at 60 h.p. for a steam pressure of 150 gage. Since this was not available five preliminary tests were run to find the maximum load that could be carried under existing conditions and also to determine the pressures in the different stages under such conditions.

The different loads were applied by means of the Prony brake mentioned above.

(c) Attaching the Calorimeters.

Having decided upon the separating calorimeter as the one

which could be used in all the stages, the housing of the turbine was tapped, calorimeter nipples fitted, and the calorimeters connected. Fig. 1, page 13 shows diagrammatically an end view with the calorimeters attached to the circumference of the housing. In the fifth and sixth stages a trap was used in place of calorimeter 2, due to the fact that water collected at the bottom of the turbine, and this prevented the flow of steam into the calorimeter. The trap was drained by means of a small cock and a rubber tube into a can partially filled with water.

(d) Performance of the Tests.

The sixth stage was the first to be tested, then the fifth, the fourth, and so on. Five tests were run on each stage; for zero load, one-quarter, one-half, three quarter, and full load, as predetermined. Each test lasted thirty minutes, readings being taken every five minutes. Considerable time elapsed between any two tests, thus letting the machine come up to the working condition caused by the new load. In starting a test for any given load in any given stage the first step was to set the brake scales to the required load, and then to apply the brake to the machine until the scale beam was kept in balance. The next step was to bring the pressure in the given stage to what it was in the preliminary test for the same load in the same stage, i.e., to the same pressure which was obtained when the machine was run without any calorimeter attached to it. This second step was accomplished by means of a valve placed between the last stage and the condenser. By adjusting this valve, the pressure in any stage could be increased to any

required value.

VI. THEORY.

In order to get the quality of the steam existing in each stage of the turbine, three calorimeters were used, as above indicated; one placed near the top, another near the bottom and the third at the side, so arranged that they were approximately 120° apart. The quality was determined for each position and the average value taken as the true quality existing in that stage.

Since separating calorimeters were used the quality in each case was determined by means of the formula $X = \frac{W}{W+S}$,

where X = quality of the steam

W = dry steam passing through the calorimeter and

S = moisture separated in the calorimeter

Let X_1 = quality of the steam in calorimeter 1

X_2 = quality of the steam in calorimeter 2 and

X_3 = " " " " " " " 3

Then $X = \frac{X_1 + X_2 + X_3}{3}$

The following nomenclature and formulae refer to the tests made upon the lower stages where, on account of moisture a steam trap had to be used.

W_e = pounds of steam collected by condenser.

$W_e \left[\frac{X_1 + X_3}{2} \right]$ = pounds of dry steam collected by condenser,

where W_1 = " " " " passing through calorimeter #1, and

W_3 = pounds of dry steam passing through calorimeter #3.

$$W = W_e \left[\frac{X_1 + X_3}{2} \right] + W_1 + W_3$$

$S_e = W_e \left[1 - \frac{X_1 + X_3}{2} \right]$ = pounds of moisture entering condenser, where

S_1 = pounds of moisture collected in Calorimeter 1.

S_3 = " " " " " " 3.

S_t = " " " " " trap.

$$S = S_e + S_1 + S_3 + S_t.$$

$$X = \frac{W}{W+3}$$

VII. DATA AND RESULTS.

- (a) Log sheets (See pp 14-28)
- (b) Result sheets (See pp 29-30)
- (c) Curve sheets (See pp 31-33)

VIII. SAMPLE CALCULATIONS.

The following calculations are typical of stages 5 and 6, in both of which the trap was used. The data is taken for zero load in the sixth stage.

$$W_e = 377$$

$$W_1 = 2.76 \quad X_1 = \frac{2.76}{2.775} = 0.995$$

$$W_3 = 1.65 \quad X_3 = \frac{1.65}{1.677} = 0.985$$

$$W_t = 0.10$$

$$S_e = 377 \left(1 - \frac{0.995 + 0.985}{2} \right) = 3.77$$

$$S_1 = 2.76 (1 - 0.995) = 0.014$$

$$S_3 = 1.65 (1 - 0.985) = 0.027$$

$$S_t = M_t = 0.01$$

$$s = 3.911$$

$$\text{quality} = \frac{381.58}{385.421} = 0.99$$

The following calculations are typical of stages 1, 2, 3 and 4, in all of which the three calorimeters were used. The data is taken for the three-quarter load in the second stage.

$$\text{Calorimeter 1 } \underline{\quad} X_1 = \frac{W_1}{W_1 + S_1} = \frac{8.66}{8.66 + 0.945} = 0.901$$

$$\text{Calorimeter 2 } \underline{\quad} X_2 = \frac{W_2}{W_2 + S_2} = \frac{3.92}{3.92 + 0.1632} = 0.961$$

$$\text{Calorimeter 3 } \underline{\quad} X_3 = \frac{W_3}{W_3 + S_3} = \frac{6.3}{6.3 + 0.433} = 0.936$$

$$\text{Average quality} = 0.933$$

IX. DISCUSSION OF RESULTS.

The two sets of curves on pages 31 to 32 show in the one case the relation of the quality in the different stages to the initial quality in the main under the various load conditions; and in the second case, they show the variation in the quality from one stage to another. In the sixth stage, the quality varies from 0.99 at zero load to 0.98 at full load, and in the fifth stage, from 0.992 at zero load to 0.989 at full load, thus showing that the quality is practically constant for these two stages, though some irregularity appears in the variation for the intermediate loads. In the fourth and third stages, the quality for the zero and full loads shows a considerable variation, in the fourth stage varying from 0.967 at zero load to 0.926 at full load, and in the third stage from 0.981 at zero load to 0.916 at full load. The quality for the intermediate loads in the third stage varies irregularly. In the

second and first stages, the full load tests were omitted altogether, due to the sticking of the brake on applying the loads. The range of the quality in the second stage was from 0.946 at zero load to 0.933 at three-quarter load, and in the first stage from 0.966 at zero load to 0.979 at three-quarter load.

In running the tests in stages 5 and 6 the quality of steam entering the condenser was taken as the average of that determined by calorimeters #1 and #3. It might be well here to note that this is only approximately correct for it was found out later that the quality varied in each stage, being higher at the top and lower at the bottom of the stage. The two calorimeters used were connected at the middle and top of the stage so this quality assumed is somewhat higher than it should be.

X. CONCLUSIONS.

(a) In any stage, as the load increases, the quality decreases, and vice - versa; i.e., the quality of the steam varies inversely as the load applied. This conclusion would naturally be expected, considering the fact that the greater the load the more work the turbine would have to do; and this work could only come from the heat in the steam, according to the transformation law of energy.

(b) The quality decreases as we go from the top to the bottom of the turbine. This is due to the fact that in running the turbine a considerable amount of water is separated from the steam through the churning action in the stages, and as this

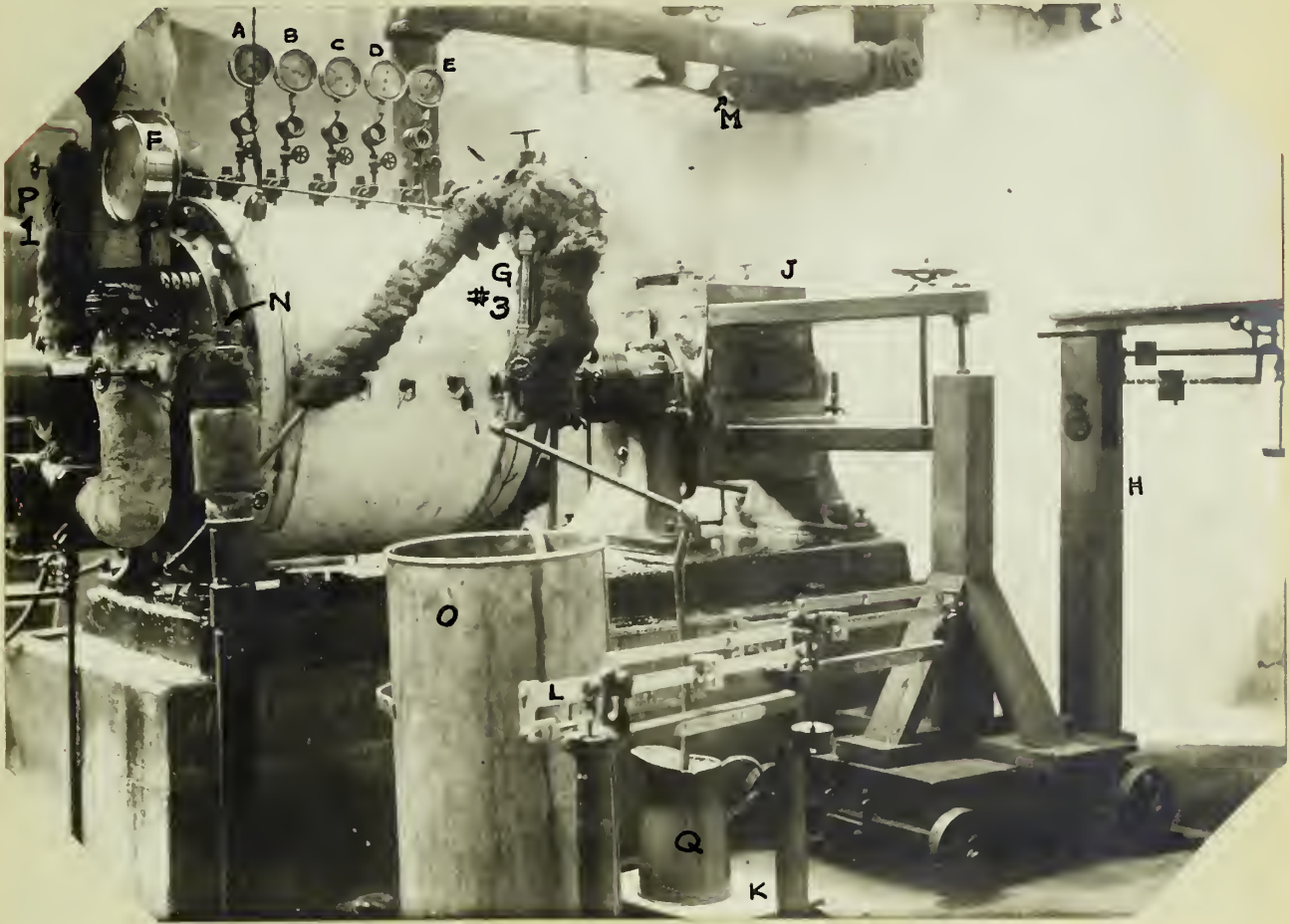
drips down over the walls the steam in the lower parts becomes denser and denser, until at the bottom there is nothing but a mixture of water and steam.

(c) As the steam flows from stage 1 to stage 6, the quality increases due to friction in the nozzles and blades and windage in the stages.

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

PLATE #1.

VIEW SHOWING THE TURBINE WITH CALORIMETER #3 ATTACHED TO THE FIRST STAGE AND THE OTHER INSTRUMENTS IN THEIR RESPECTIVE POSITIONS.

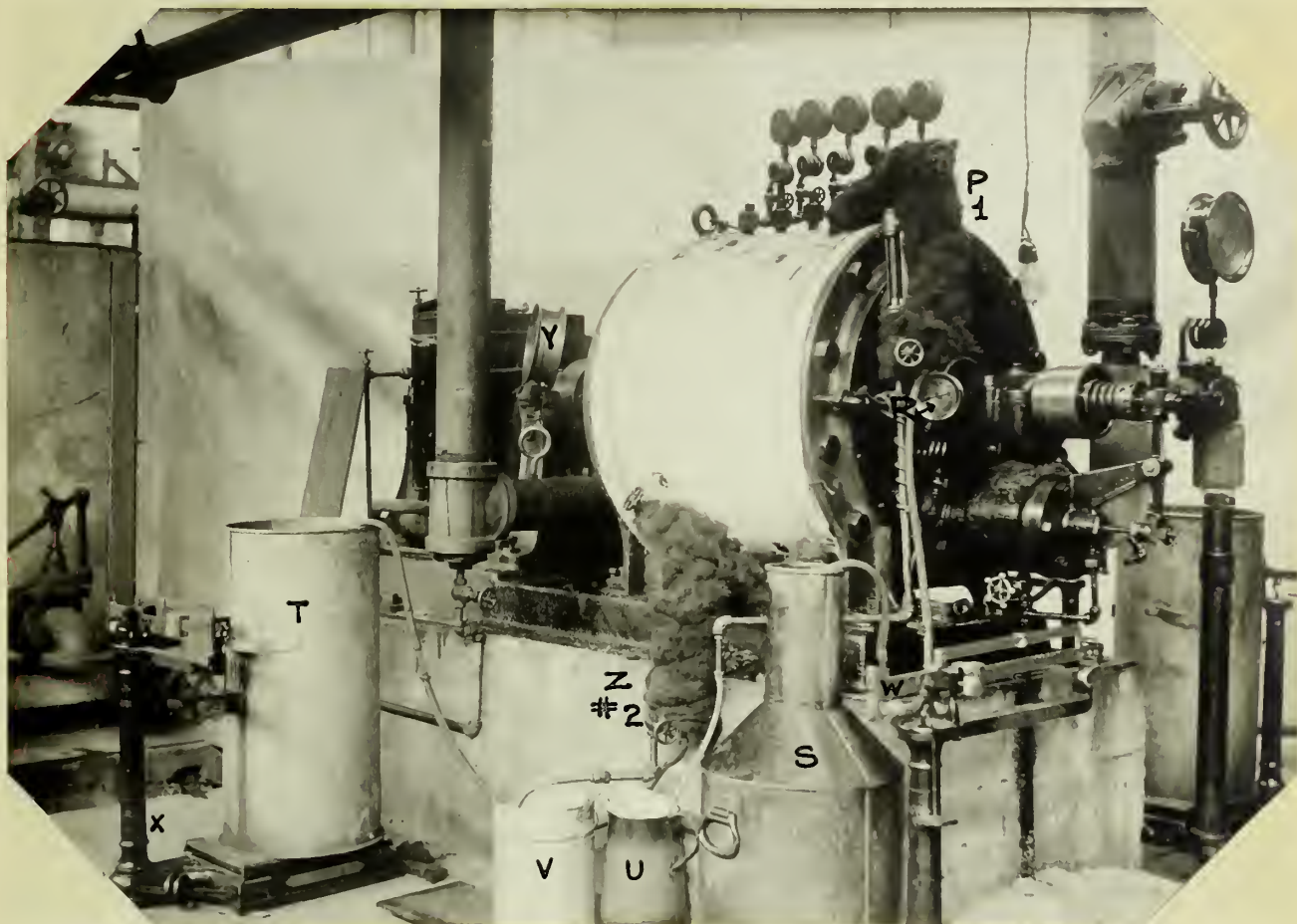


- A— STEAM GAGE FOR DETERMINING PRESSURE IN STAGE # 1
- B— " " " " " " " 2
- C— " " " " " " " 3
- D— " " " " " " " 4
- E— " " " " " " " 5
- F— " " " " " " MAIN
- G— SEPARATING CALORIMETER #3
- H— PRONY BRAKE SCALE
- J— PRONY BRAKE
- K— SCALE FOR WEIGHING WATER SEPARATED FROM STEAM IN CAL.#3
- L— " " " EXHAUST STEAM FROM CALORIMETER #3
- M— VALVE IN EXHAUST FOR PRODUCING DESIRED BACK PRESSURE
- N— THERMOMETER CUP IN THROTTLING CALORIMETER IN MAIN LINE
- O— CONDENSATE CAN FOR CAL.#3
- P— CALORIMETER #1
- Q— SEPARATED WATER CAN FOR CAL.#3

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

PLATE #2

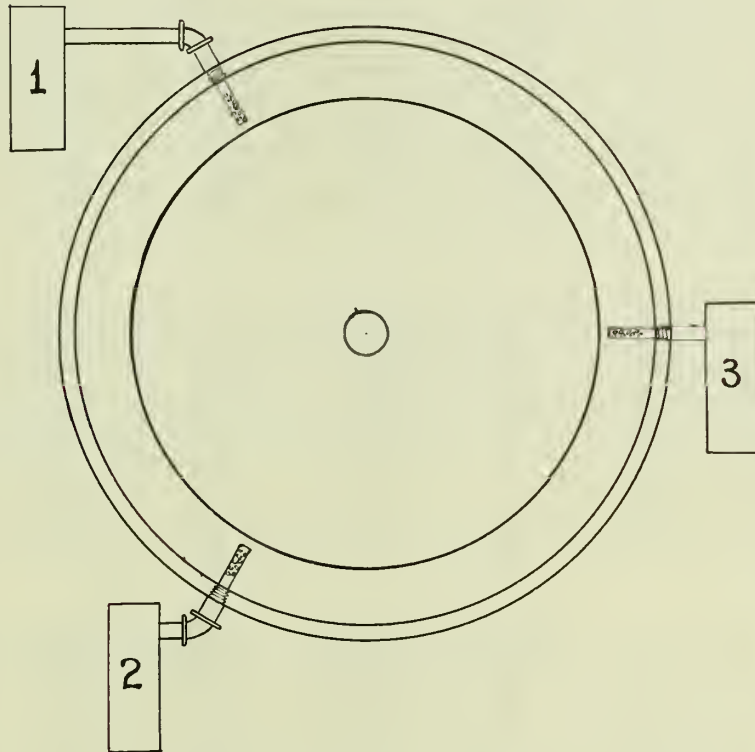
VIEW SHOWING THE TURBINE FROM THE OPPOSITE SIDE TO THAT SHOWN IN PLATE #1 AND SHOWING CALORIMETERS #1 AND #3 ATTACHED TO STAGE #1 AND THE OTHER INSTRUMENTS IN THEIR RESPECTIVE POSITIONS.



- P — CALORIMETER # 1
- R — GAGE BELOW THROTTLE
- S — EXHAUST STEAM CAN FOR CAL.# 1
- T — " " " " " " 2
- U — SEPARATED WATER " " " " 1
- V — " " " " " " 2
- W — SCALE FOR EXHAUST STEAM FROM CAL # 1
- X — " " " " " " 2
- Y — GAGE IN SIXTH STAGE
- Z — CALORIMETER # 2

PLATE # 3

SKETCH SHOWING SECTION OF TURBINE AND LOCATION OF THE CALORIMETERS WITH RESPECT TO THE HOUSING, AND THE NUMBER ASSIGNED TO EACH CALORIMETER.



STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE.

PRELIMINARY TESTS FOR DETERMINING, WITHOUT CALORIMETERS INSERTED, THE PRESSURES IN THE DIFFERENT STAGES —

LOAD	R.P.M	P R E S S U R E S.						
		BELOW THROTTLE	I N S T A G E S					
			1	2	3	4	5	6
0	3600	30	16.6	10	6.0	3.7	2.8	2.0
"	"	31	16.7	10	6.1	3.8	2.85	2.0
"	"	31	16.6	10	6.2	3.8	2.9	2.0
"	"	31	16.7	10	6.1	3.8	2.9	2.0
"	"	31	16.8	10	6.2	3.9	2.9	2.1
"	"	31	16.7	10	6.2	3.9	2.9	2.1
"	"	31	16.7	10	6.2	3.9	3.0	2.1
1/4	3600	50	26	16.7	10.1	5.9	3.3	2.0
"	"	52	27.1	17.1	10.5	6.1	3.8	2.0
"	"	53	28.	18.2	11.0	6.2	3.8	2.0
"	"	53	27.5	18.0	10.8	6.1	3.7	2.0
"	"	52	27.	17.5	10.8	6.1	3.7	2.0
"	"	53	27.5	18.0	10.8	6.1	3.7	2.0
"	"	53	27.5	18.0	10.9	6.1	3.8	2.0
1/2	3600	70	41.	27	16	8.9	4.7	2.0
"	"	70	41	26.8	16	8.9	4.7	2.0
"	"	70	40.5	26.5	16	8.9	4.7	2.1
"	"	70	41	27.0	16	9.0	4.8	2.0
"	"	70	41	26.9	16	8.9	4.7	2.0
"	"	70	41	27.	16	8.9	4.7	2.0
"	"	70	41	27.	16	9.0	4.8	2.0
3/4	3600	95	54.5	35.5	22.	11.9	6	1.9
"	"	93	54.	35.4	21.9	11.8	6	1.9
"	"	93	54.	35.2	22	11.8	6	1.9
"	"	93	54.	35.4	22	11.8	6	1.9
"	"	93	54.	35.3	22	11.8	6	1.9
"	"	94	54.	35.4	22	11.8	6	1.9
"	"	93	54.	35.4	22	11.8	6	1.9
FULL	3600	112	66	45.	27	15	8.2	2
"	"	115	67	45.2	28	15	8	2
"	"	114	67	45.2	28	15	8	2
"	"	115	67	45.2	28	15	8	2
"	"	115	67	45.2	28	15	8	2
"	"	114	67	45.2	28	15	8	2
"	"	115	67	45.2	28	15	8	2

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 1
LOAD 0
BAROMETER 29.791 " Hg.

CALORIMETER #1				CALORIMETER #2				CALORIMETER #3				R.P.M	TEMP. IN MAIN CAL. OF	PRESSURES # GAUGE					
STEAM CONDENSED LB	WATER DRAINED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	WATER DRAINED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	WATER DRAINED LB	GAUGE READING LB	WATER DRAINED LB			IN MAIN	BELOW THROTTLE	IN STAGES			
513.20	.000	—	123.55	.000	—	118.29	.000	—	3600	284	134	16.7	10.0	5.0	2.8	1.2	0.0		
513.74	.006	—	124.00	.003	—	118.92	.001	—	"	284	134	"	9.5	5.1	"	1.2	"		
514.56	.013	—	124.26	.004	—	119.51	.002	—	"	280	134	"	10.0	5.3	"	1.3	"		
515.48	.015	—	124.68	.007	—	120.14	.004	—	"	278	133	"	10.0	5.4	"	1.3	"		
516.24	.023	—	125.05	.012	—	120.83	.005	—	"	278	134	"	10.0	5.3	"	1.3	"		
517.14	.025	—	125.50	.014	—	121.46	.011	—	"	279	137	"	10.0	5.2	"	1.3	"		
518.51	.028	—	125.93	.016	—	122.10	.016	—	"	278	136	"	10.0	5.2	"	1.3	"		

STAGE 1
LOAD 1/4
BAROMETER 29.469 " Hg.

511.06	.000	—	119.98	.002	—	116.85	.010	—	3540	271	113	27.3	18.2	10.5	5.6	3.4	1.4
512.16	.027	—	120.56	.005	—	117.76	.015	—	3600	270	117	"	18.1	"	5.6	3.4	1.5
513.56	.049	—	121.09	.013	—	118.68	.030	—	3600	269	123	"	18.1	"	5.7	3.4	1.5
514.44	.079	—	121.71	.029	—	119.60	.052	—	3600	270	130	"	18.0	"	5.7	3.5	1.6
516.08	.096	—	122.30	.037	—	120.48	.075	—	3600	272	128	"	18.0	"	5.7	3.5	1.6
517.16	.109	—	122.82	.056	—	121.42	.090	—	3600	275	119	"	18.0	"	5.6	3.4	1.4
518.36	.123	—	123.42	.064	—	122.10	.106	—	3600	274	120	"	18.0	"	5.6	3.5	1.5

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 1
LOAD 1/2

BAROMETER 29.471 " Hg.

CALORIMETER #1		CALORIMETER #2				CALORIMETER #3				R.P.M.	TEMP. IN MAIN CAL. OF	PRESSURES						# GAUGE						
		STEAM CONDENSED	GAUGE READING	WATER DRAINED	LB	STEAM CONDENSED	GAUGE READING	WATER DRAINED	LB			STEAM CONDENSED	GAUGE READING	WATER DRAINED	LB	IN MAIN	BELow THROTTLE		IN STAGES					
LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB
120.12	.000	—	534.74	.014	—	—	—	—	119.48	.025	—	—	—	3600	278	130	83	44.0	30.0	17.6	9.6	5.3	2.1	6
120.77	.011	—	535.64	.040	—	—	—	—	120.61	.054	—	—	—	"	278	126	78	41.0	27.6	16.0	8.8	4.7	1.9	—
121.54	.022	—	536.98	.068	—	—	—	—	121.86	.088	—	—	—	"	277	122	76	41.0	27.5	16.0	8.8	4.7	1.8	—
122.26	.048	—	538.98	.104	—	—	—	—	123.00	.129	—	—	—	"	271	127	77	41.0	27.6	16.0	8.8	4.7	1.9	—
122.96	.064	—	539.95	.142	—	—	—	—	124.26	.166	—	—	—	"	270	131	75	41.0	27.3	15.8	8.5	4.5	1.8	—
123.71	.083	—	541.64	.174	—	—	—	—	125.39	.200	—	—	—	"	272	131	75	41.0	27.0	15.5	8.4	4.5	1.9	—
124.40	.101	—	543.35	.205	—	—	—	—	126.59	.236	—	—	—	"	273	132	75	41.0	27.0	15.5	8.4	4.5	1.9	—

STAGE 1
LOAD 3/4

BAROMETER 29.790 " Hg.

525.98	.022	—	119.81	.026	—	—	—	—	120.26	.020	—	—	—	3600	284	125	97	54.0	36.4	22.0	11.8	6.4	2.1	—
527.82	.057	—	120.89	.050	—	—	—	—	121.74	.060	—	—	—	"	278	127	97	"	36.5	22.0	11.8	6.4	2.4	—
529.90	.090	—	121.82	.072	—	—	—	—	123.23	.108	—	—	—	"	278	126	97	"	36.3	22.0	11.8	6.4	2.1	—
531.90	.125	—	122.66	.085	—	—	—	—	124.62	.158	—	—	—	"	278	130	97	"	36.0	22.0	12.0	6.8	2.1	—
533.82	.161	—	123.62	.100	—	—	—	—	126.08	.207	—	—	—	"	278	127	96	"	36.0	22.0	12.0	6.8	2.8	—
535.72	.190	—	124.52	.121	—	—	—	—	127.50	.238	—	—	—	"	283	123	96	"	36.0	22.1	12.1	6.8	2.7	—
537.80	.218	—	125.44	.140	—	—	—	—	128.93	.269	—	—	—	"	280	126	97	"	36.1	22.1	12.0	6.8	2.7	—

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM
IN THE DIFFERENT STAGES OF THE KERR TURBINE.

STAGE 2.
LOAD 0.

BAROMETER 28.873 " Hg

CALORIMETER #1		CALORIMETER #2		CALORIMETER #3			R.P.M.	TEMP. IN MAIN CAL. OF	P R E S S U R E S . * GAUGE.									
STEAM CONDENSED LB.	GAUGE READING LB.	STEAM CONDENSED LB.	GAUGE READING LB.	WATER DRAINED LB.	WATER DRAINED LB.	WATER DRAINED LB.			IN MAIN	BELOW THROTTLE	1	2	3	4	5	6		
508.53	.026	7.34	114.51	.070	4.02	115.22	.014	4.12	3600	277	134	35	17.0	10.0	5.1	3.0	1.0	0
509.04	.045	"	114.87	.118	"	115.80	.038	"	"	277	137	35	17.0	10.0	5.1	3.0	1.0	0
509.70	.059	"	115.16	.163	"	116.27	.059	"	"	280	134	35	17.0	10.0	5.1	3.0	1.2	0
510.49	.085	"	115.43	.200	"	116.82	.081	"	"	279	139	36	17.0	10.0	5.1	3.0	1.2	0
511.22	.093	"	115.76	.23 ^{ET} _{.004}	"	117.35	.098	"	"	279	132	36	17.0	10.0	5.1	2.9	1.2	0
512.00	.099	"	116.09	.020	"	117.85	.109	"	"	278	128	35	17.0	10.0	5.1	2.9	1.2	0
512.75	.110	7.34	116.37	.065	4.25	118.37	.125	4.12	"	276	130	36	17.0	10.0	5.1	2.9	1.1	0

ET = EMPTIED TO.

STAGE 2.
LOAD 1/4.

BAROMETER 28.864 " Hg

501.56	.015	7.71	117.94	.032	4.76	114.62	.029	4.78	3600	273	124	52	27.0	17.5	10.4	6.0	3.7	1.9
502.18	.070	"	118.31	.130	"	115.26	.078	"	"	274	125	52	27.0	17.5	10.4	6.0	3.7	1.9
503.89	.120	"	118.76	.220	"	115.95	.112	"	"	275	122	52	26.8	17.5	10.3	6.0	3.5	1.9
504.50	.178	"	119.14	.27 ^{ET} _{.046}	"	116.68	.150	"	"	274	122	52	27.0	17.5	10.3	6.0	3.5	1.9
505.10	.223 ^{ET} _{.048}	"	119.64	.15	"	117.31	.193	"	"	273	127	52	27.0	17.5	10.3	6.0	3.6	1.9
505.72	.084	"	120.00	.23 ^{ET} _{.048}	"	117.97	.241 ^{ET} _{.05}	"	"	273	132	52	27.0	17.5	10.3	6.0	3.6	1.9
506.94	.142	7.92	120.36	.121	5.19	118.72	.079	4.96	"	272	135	52	27.0	17.5	10.3	6.0	3.6	2.0

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 2
LOAD 1/2

BAROMETER 28.864 " Hg.

CALORIMETER #1				CALORIMETER #2				CALORIMETER #3				R.P.M.	TEMP. IN MAIN CAL. OF	PRESSURES						# GAUGE
STEAM CONDENSED	GAUGE READING	WATER DRAINED	LB	STEAM CONDENSED	GAUGE READING	WATER DRAINED	LB	STEAM CONDENSED	GAUGE READING	WATER DRAINED	LB			IN MAIN	BELOW THROTTLE	IN STAGES				
LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	1	2	3	4	5	6			
516.27	.048	8.31		124.41	.078	5.70		119.04	.020	5.46		278	123	73	27.0	17.5	10.4	6.0	3.7	2.0
517.12	—	"		126.00	—	"		119.84	—	"		275	125	72	27.0	"	10.4	6.0	3.7	1.9
518.42	—	"		126.55	—	"		120.73	—	"		273	129	73	26.8	"	10.3	6.0	3.5	2.0
519.58	—	"		127.05	—	"		121.66	—	"		274	133	73	27.0	"	10.3	6.0	3.5	2.0
521.10	—	"		127.63	—	"		122.56	—	"		273	138	74	27.0	"	10.3	6.0	3.6	2.0
521.99	—	"		128.06	—	"		123.49	—	"		275	138	73	27.0	"	10.3	6.0	3.6	2.0
523.61	.096	8.84		128.61	.165	6.71		124.46	.180	5.61		274	133	73	27.0	"	10.3	6.0	3.6	2.0

STAGE 2
LOAD 3/4

BAROMETER 28.860 " Hg.

508.00	.045	9.38		124.30	.068	7.49		119.91	.035	6.06		279	126	95	54.5	35.4	21.5	11.8	6.3	2.1
509.32	—	"		125.03	—	"		121.12	—	"		279	127	97	54.5	"	21.5	11.8	6.0	2.1
510.63	—	"		125.64	—	"		122.11	—	"		279	126	96	54.0	"	21.0	11.7	6.0	1.9
512.38	—	"		126.31	—	"		123.19	—	"		280	122	95	54.3	"	21.2	11.7	6.0	1.9
513.64	—	"		126.93	—	"		124.13	—	"		279	124	94	54.0	"	21.0	11.7	6.0	1.9
515.00	—	"		127.59	—	"		125.17	—	"		280	122	95	54.0	"	21.2	11.8	6.0	1.9
516.66	.160	10.21		128.22	.270	8.92		126.21	.138	6.39		277	121	97	54.5	"	21.3	11.8	6.0	1.9

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 3
LOAD 0

BAROMETER 29.196 " Hg.

CALORIMETER #1				CALORIMETER #2				CALORIMETER #3				R.P.M.	TEMP. IN MAIN CAL. °F	PRESSURES						# GAUGE
STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	IN MAIN	BELOW THROTTLE	IN STAGES									
LB	LB	LB	LB	LB	LB	LB	LB	LB			1	2	3	4	5	6				
103.19	.000	—	68.75	.003	—	68.62	.000	—	3600	270	129	18.0	12.0	6.2	3.5	2.1	.8			
103.84	.002	—	69.00	.010	—	69.15	.001	—	"	270	128	18.0	11.6	"	"	2.1	.8			
104.73	.003	—	69.26	.016	—	69.70	.002	—	"	270	128	18.0	11.0	"	"	2.1	.8			
105.11	.004	—	69.48	.022	—	70.01	.009	—	"	269	131	18.5	11.9	"	"	2.1	.7			
105.66	.005	—	69.68	.029	—	70.55	.100	—	"	270	134	18.5	12.0	"	"	2.1	.7			
106.33	.006	—	69.93	.041	—	70.95	.140	—	"	272	135	18.5	12.0	"	"	2.2	.7			
107.23	.009	—	70.17	.050	—	71.41	.150	—	"	270	133	18.5	12.0	"	"	2.2	.6			

STAGE 3
LOAD ¼

BAROMETER 29.310" Hg.

118.28	.010	—	73.24	.003	—	74.00	.017	—	3600	272	122	35.2	24.8	16.0	11.0	8.3	0.0
119.24	.059	—	73.62	.058	—	74.65	.045	—	"	273	124	35.2	24.3	16.0	11.0	8.3	"
120.12	.093	—	74.00	.087	—	75.30	.077	—	"	274	123	35.0	24.0	16.0	11.0	8.2	"
121.01	.123	—	74.40	.124	—	76.06	.102	—	"	276	120	35.1	24.3	16.0	11.0	8.2	"
121.86	.169	—	74.80	.158	—	76.70	.136	—	"	274	120	34.9	24.1	15.9	11.1	8.8	"
122.90	.211	—	75.24	.198	—	77.44	.174	—	"	271	125	35.0	24.3	16.0	11.7	9.0	"
123.71	.260	—	75.67	.228	—	78.09	.210	—	"	274	129	35.0	24.5	16.0	11.8	9.0	"

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM
IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 3
LOAD 1/2
BAROMETER 29.207 " Hg.

CALORIMETER # 1		CALORIMETER # 2		CALORIMETER # 2		R.P.M.	TEMP IN MAIN CAL OF MAIN	PRESSURES						# GAUGE	
STEAM CONDENSED LB	WATER DRAINED LB	STEAM CONDENSED LB	WATER DRAINED LB	STEAM CONDENSED LB	GUAGE READING LB			WATER DRAINED LB	IN MAIN	BELOW THROTTLE	1	2	3		4
112.85	.003	71.16	.098	5.48	.020	3600	272	132	73	41.5	28.0	16.0	8.9	4.8	2.0
113.73	.010	71.53	—	"	.025	"	272	136	76	41.5	28.0	"	9.0	4.8	2.1
114.73	.019	72.00	—	"	.030	"	274	134	74	41.4	28.0	"	9.0	4.8	1.9
115.80	.029	72.42	—	"	.041	"	275	133	74	41.2	27.9	"	9.0	4.8	1.9
116.65	.035	72.82	—	"	.065	"	271	132	75	41.4	27.6	"	9.0	5.0	2.1
117.39	.045	73.22	—	"	.084	"	271	134	74	41.3	27.6	"	9.0	5.0	2.1
118.49	.055	73.62	.270	6.14	.093	"	271	133	75	41.3	27.6	"	9.0	5.0	2.0

STAGE 3
LOAD 3/4
BAROMETER 29.218 " Hg.

110.05	.000	70.47	.070	4.820	.005	3600	279	119	95	54.5	37.4	22.0	12.0	6.6	2.3
111.07	.015	70.89	—	"	.015	"	276	124	96	54.0	37.0	"	"	6.5	2.3
112.24	.025	71.36	—	"	.039	"	275	131	96	54.0	37.0	"	"	6.5	2.3
113.39	.033	71.89	—	"	.059	"	277	133	97	54.3	37.0	"	"	6.5	2.2
114.50	.041	72.39	—	"	.083	"	279	130	96	54.0	37.0	"	"	6.5	2.3
115.59	.050	72.84	—	"	.106	"	280	126	96	54.0	37.0	"	"	6.5	2.3
116.71	.058	73.34	.250	5.276	.130	"	280	128	96	54.0	37.0	"	"	6.5	2.3

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 3
LOAD FULL
BAROMETER 29.144 " Hg.

CALORIMETER #1				CALORIMETER #2				CALORIMETER #3				R.P.M.	TEMP IN MAIN CAL. °F	PRESSURES . # GAUGE					
STEAM CONDENSED LB	GAUGE READING LB	WATER CONDENSED LB	STEAM GAUGE READING LB	WATER DRAINED LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	WATER DRAINED LB	IN MAIN	BELOW THROTTLE			1	2	3	4	5	6
102.26	.014	—	61.93	.097	4.93	73.32	.009	—	—	3600	281	130	67.0	46.0	28.0	15.5	8.8	3.6	
103.54	.032	—	62.49	—	"	74.28	.035	—	—	"	279	132	67.0	46.0	28.0	15.5	8.8	3.4	
104.73	.048	—	63.02	—	"	75.17	.067	—	—	"	282	127	67.0	45.5	"	15.3	8.5	3.5	
105.16	.068	—	63.66	—	"	76.13	.090	—	—	"	280	133	66.8	46.0	"	15.4	8.5	3.4	
106.47	.081	—	64.17	—	"	77.10	.123	—	—	"	281	133	67.0	46.0	"	15.5	8.7	3.5	
107.67	.097	—	64.71	—	"	78.00	.142	—	—	"	283	127	67.0	46.0	"	15.5	8.8	3.3	
109.85	.120	—	65.24	.158	5.76	79.00	.166	—	—	"	283	122	67.0	46.0	"	15.5	8.5	3.2	

STAGE 4
LOAD 0
BAROMETER 29.154 " Hg.

112.86	.000	—	68.55	.033	—	72.43	.017	—	—	3600	279	135	19.5	12.0	6.7	3.8	2.4	.9
113.41	.002	—	68.63	.038	—	72.81	.012	—	—	"	276	138	19.0	12.3	7.0	3.8	2.5	"
114.00	.003	—	68.75	.048	—	73.18	.018	—	—	"	278	139	19.0	12.4	6.9	3.8	2.5	"
114.48	.005	—	68.86	.058	—	73.58	.026	—	—	"	279	140	19.0	12.3	6.9	3.8	2.4	"
115.00	.009	—	68.97	.065	—	73.95	.035	—	—	"	278	140	19.5	12.0	6.9	3.8	2.5	"
115.51	.014	—	69.10	.072	—	74.32	.051	—	—	"	280	135	19.5	12.0	6.8	3.7	2.4	"
116.16	.022	—	69.16	.083	—	74.76	.058	—	—	"	275	136	19.5	12.0	6.8	3.8	2.4	"

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE.

STAGE 4
LOAD $\frac{1}{4}$
BAROMETER 29.056 " Hg.

CALORIMETER #1				CALORIMETER #2				CALORIMETER #3			R.P.M.	TEMP. IN MAIN CAL OF	PRESSURES IN STAGES						# GAUGE
STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	IN MAIN	BELOW THROTTLE			1	2	3	4	5	6	
106.04	.021	—	73.32	.026	—	74.21	.015	—	3600	272	134	28.0	18.5	10.9	6.0	3.6	1.9		
106.71	.023	—	73.46	.032	—	74.61	.021	—	"	274	136	27.3	18.1	10.5	5.9	3.5	1.9		
107.34	.027	—	73.62	.040	—	75.07	.027	—	"	273	137	27.5	18.3	10.8	6.0	3.6	1.8		
107.96	.034	—	73.72	.051	—	75.53	.037	—	"	276	132	27.0	18.0	10.5	6.0	3.5	1.8		
108.52	.040	—	73.89	.060	—	75.95	.052	—	"	274	128	27.0	18.0	10.5	6.0	3.5	1.9		
109.19	.049	—	74.00	.069	—	76.43	.068	—	"	271	127	27.4	18.2	10.8	6.0	3.6	1.8		
109.85	.054	—	74.10	.082	—	76.96	.090	—	"	270	131	28.0	18.3	11.0	6.0	3.7	1.9		

STAGE 4
LOAD $\frac{1}{2}$
BAROMETER 29.050 " Hg.

100.67	.003	—	66.31	.040	—	65.78	.016	—	3600	273	136	41.5	28.0	16.5	9.0	4.7	2.0
101.40	.016	—	66.51	.057	—	66.17	.027	—	"	273	137	41.5	28.0	16.5	9.0	4.7	"
102.11	.028	—	66.70	.076	—	66.74	.046	—	"	279	130	41.0	27.5	16.0	8.9	4.6	"
102.80	.034	—	66.89	.084	—	67.25	.070	—	"	272	131	41.4	27.8	16.3	9.0	4.7	"
103.55	.046	—	67.06	.105	—	67.85	.095	—	"	270	138	41.8	28.0	16.5	9.0	4.7	"
104.19	.058	—	67.26	.115	—	68.33	.121	—	"	276	136	41.5	27.8	16.2	8.9	4.7	"
104.95	.070	—	67.45	.142	—	68.82	.140	—	"	274	135	41.5	28.0	16.2	8.9	4.7	"

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE.

STAGE 4
LOAD $\frac{3}{4}$

BAROMETER 29.074 "Hg.

CALORIMETER #1				CALORIMETER #2				CALORIMETER #3				R.P.M.	TEMP. IN MAIN CAL °F	PRESSURES						# GAUGE.	
STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB			IN MAIN	BELOW THROTTLE			IN STAGES			
															1	2	3	4	5		6
111.68	.041	—	72.59	.034	—	72.25	.055	—	3600	273	107	98	54.0	37.5	22.0	11.5	5.8	1.4			
112.49	.050	—	72.73	.057	—	72.83	.057	—	"	272	111	96	54.5	37.0	22.0	11.7	6.0	1.4			
113.37	.069	—	73.02	.070	—	73.40	.083	—	"	270	119	95	54.0	36.3	22.0	11.6	5.8	1.3			
114.09	.093	—	73.12	.094	—	73.98	.125	—	"	272	128	94	54.0	36.0	21.5	11.5	5.5	1.3			
115.06	.116	—	73.41	.114	—	74.60	.158	—	"	274	134	95	54.5	37.0	22.0	11.7	5.6	1.3			
115.65	.129	—	73.65	.132	—	75.20	.190	—	"	278	135	94	53.5	36.0	21.3	11.4	5.5	1.3			
116.56	.149	—	73.85	.158	—	75.81	.219	—	"	279	130	93	53.0	35.5	21.0	11.4	5.4	1.3			

STAGE 4
LOAD FULL

BAROMETER 29.038 "Hg.

106.89	.028	—	68.94	.054	—	70.07	.043	—	3600	278	132	114	65.0	44.0	27.0	14.3	7.2	1.8
107.89	.054	—	69.20	.098	—	70.72	.085	—	"	279	136	113	65.5	44.0	27.0	14.4	7.2	1.8
108.72	.088	—	69.50	.144	—	71.45	.133	—	"	279	133	115	66.7	45.0	27.5	14.8	7.5	1.9
109.62	.122	—	69.73	.180	—	72.07	.170	—	"	279	137	116	66.7	45.0	27.5	14.8	7.5	1.8
110.46	.150	—	69.97	.217	—	72.78	.206	—	"	284	130	114	65.5	44.0	27.0	14.4	7.2	1.8
111.62	.179	—	70.12	.25 ^{E.T.} .086	—	73.45	.258	—	"	282	126	113	66.5	45.0	27.5	14.8	7.3	1.8
112.42	.212	—	70.40	.012	—	74.14	.072 ^{E.T.} .046	—	"	280	122	116	67.0	45.0	28.0	15.0	8.0	2.3

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 5
LOAD 0

BAROMETER 29.252 " Hg.

CALORIMETER #1		STEAM		TRAP #2		CALORIMETER #3		R.P.M.	TEMP IN MAIN CAL OF	PRESSURES						
GAUGE READING LB	WATER DRAINED LB	CONDENSED IN LB	TARE LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB			IN MAIN	BELOW THROTTLE	IN STAGES				
										1	2	3	4	5	6	
110.08	.178	523	523	—	73.40	.026	—	3600	274	137	19.5	12.2	7.2	4.4	3.0	1.9
110.51	.180	584	"	—	73.65	.029	—	"	271	126	19.5	12.0	7.2	4.4	"	1.8
111.00	.182	649	"	—	73.90	.031	—	"	264	120	19.0	12.0	7.2	4.4	"	1.7
111.46	.183	704	"	—	74.22	.037	—	"	260	116	19.0	12.0	7.3	4.4	"	1.8
111.97	.186	764	"	—	74.45	.040	—	"	254	112	19.0	12.0	7.3	4.4	"	1.7
112.44	.187	825	"	—	74.78	.045	—	"	251	117	19.5	12.2	7.5	4.5	"	1.8
112.85	.188	885	"	.25	75.07	.050	—	"	255	118	19.5	12.5	7.5	4.5	"	1.9

STAGE 5
LOAD 1/4

BAROMETER 29.252 " Hg.

110.45	.143	540	540	—	69.67	.037	—	3600	265	121	27.5	18.0	10.6	6.2	3.7	2.1
110.97	.145	611	"	—	70.02	.039	—	"	262	121	28.0	"	11.0	6.4	"	2.1
111.51	.155	699	"	—	70.35	.045	—	"	263	123	28.0	"	10.9	6.4	"	2.2
112.04	.160	776	"	—	70.70	.050	—	"	264	123	28.0	"	10.9	6.4	"	2.2
112.70	.161	875	"	—	71.10	.054	—	"	262	127	28.0	"	11.0	6.4	"	2.2
113.08	.164	942	"	—	71.40	.057	—	"	262	131	28.0	"	11.0	6.4	"	2.2
113.63	.167	1019	"	.31	71.72	.060	—	"	262	140	28.0	"	11.0	6.5	"	2.3

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 5
LOAD 1/2
BAROMETER 29.232 " Hg.

CALORIMETER #1		STEAM		TRAP #2	CALORIMETER #3			R.P.M.	TEMP IN MAIN CAL OF MAIN	PRESSURES					# GAUGE	
GAUGE READING LB	WATER DRAINED LB	CONDENSED IN CONDENSER LB	TARE LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB			IN MAIN	BELOW THROTTLE	1	2	3		4
108.88	.092	—	582	582	73.61	.025	—	3600	261	117	42.0	27.9	16.5	9.2	4.7	2.1
109.48	.104	—	693	"	74.00	.029	—	"	258	127	42.0	28.0	16.8	9.2	"	"
110.03	.107	—	794	"	74.44	.040	—	"	257	140	42.5	28.0	16.8	9.2	"	"
110.65	.119	—	909	"	74.88	.058	—	"	266	133	42.0	27.7	16.5	9.2	"	"
111.26	.121	—	1016	"	75.31	.070	—	"	264	135	42.0	27.5	16.2	9.1	"	"
112.00	.123	—	1127	"	75.71	.088	—	"	266	133	42.0	28.0	16.3	9.1	"	"
112.47	.126	—	1252	"	76.14	.109	—	"	269	131	42.0	28.0	16.1	9.1	"	"

STAGE 5
LOAD 3/4
BAROMETER 29.204 " Hg.

104.64	.072	—	492	492	70.63	.025	—	3600	270	133	55.0	37.0	22.0	12.0	6.0	2.0
105.24	.080	—	635	"	71.03	.030	—	3580	271	136	55.0	37.0	22.0	"	"	"
105.87	.090	—	768	"	71.56	.038	—	3600	270	140	54.5	36.0	22.0	"	"	"
106.58	.095	—	904	"	72.00	.040	—	3600	274	137	54.5	36.0	22.0	"	"	"
107.23	.102	—	1055	"	72.45	.049	—	3600	275	135	54.5	36.0	22.0	"	"	"
107.88	.104	—	1194	"	72.83	.060	—	3600	277	128	54.5	36.0	22.0	"	"	"
108.51	.110	—	1346	"	73.37	.072	—	3600	275	124	54.0	36.2	22.1	"	"	"

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 5
LOAD FULL
BAROMETER 29.278 " Hg.

CALORIMETER #1		STEAM		TRAP #2	CALORIMETER #3		R.P.M	TEMP IN MAIN CAL OF	PRESSURES # GAUGE							
STEAM CONDENSED IN CONDENSER LB	WATER DRAINED LB	TARE LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB			IN MAIN	BELOW THROTTLE	IN STAGES			# GAUGE		
LB	LB	LB	LB	LB	LB	LB			1	2	3	4	5	6		
110.85	.040	—	650	650	.046	—	3600	279	132	118	67.5	45.0	28.0	15.0	8.0	2.1
111.53	.046	—	812	"	.050	—	3600	278	127	117	67.5	46.0	"	15.2	"	2.1
112.26	.052	—	977	"	.057	—	3600	278	122	115	67.2	46.0	"	15.2	"	2.2
113.04	.058	—	1148	"	.069	—	3600	276	124	120	68.0	46.0	"	15.2	"	2.3
113.75	.061	—	1317	"	.080	—	3570	277	123	116	67.8	46.0	"	15.1	"	2.2
114.46	.064	—	1474	"	.091	—	3600	276	123	118	68.0	46.0	"	15.2	"	2.2
114.18	.066	—	1627	"	.118	—	3600	276	127	117	67.5	45.0	"	15.0	"	2.2

SCALE 6
LOAD 0
BAROMETER 29.142 " Hg.

102.61	.140	—	548	548	.050	—	3620	251	120	40	20.0	13.0	8.2	4.7	3.4	2.1
103.12	.141	—	607	"	.052	—	3630	257	122	"	20.0	13.0	8.0	4.7	3.4	2.1
103.56	.145	—	674	"	.056	—	3618	254	119	"	20.0	13.7	8.0	4.5	3.2	2.0
104.00	.148	—	734	"	.060	—	3600	248	120	"	20.0	13.0	8.0	4.5	3.3	2.0
104.47	.150	—	797	"	.068	—	3600	248	120	"	20.0	13.0	8.0	4.5	3.2	2.0
104.94	.154	—	863	"	.070	—	3600	251	122	"	20.5	13.0	8.2	4.6	3.2	2.1
105.37	.155	—	925	"	.077	—	3620	254	120	"	20.0	13.8	8.0	4.5	3.2	2.1

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 6
LOAD 1/4
BAROMETER 29.136 " Hg.

CALORIMETER #1				STEAM		TRAP #2			CALORIMETER #3			R.P.M	TEMP IN MAIN CAL °F	PRESSURES # GAUGE					
STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	CONDENSED IN CONDENSER LB	TARE LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB			IN MAIN	BELOW THROTTLE	IN STAGES			# GAUGE
LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	1	2	3	4	5	6		
103.58	.052	—	560	560	—	76.40	.033	—	3600	252	120	27.0	17.5	10.5	6.0	3.6	2.0		
104.00	.057	—	648	"	—	76.72	.039	—	3600	253	120	"	17.5	10.5	6.0	3.7	"		
104.46	.062	—	720	"	—	76.94	.040	—	3625	256	122	"	17.5	10.5	6.0	3.7	"		
104.90	.077	—	810	"	—	77.22	.047	—	3620	257	127	"	17.4	10.4	6.0	3.6	"		
105.41	.081	—	890	"	—	77.50	.052	—	3635	258	130	"	17.4	10.5	6.0	3.6	"		
105.82	.090	—	972	"	—	77.77	.056	—	3600	261	129	"	17.0	10.3	5.9	3.5	"		
106.27	.104	—	1048	"	.14	78.01	.060	—	3600	259	130	"	17.0	10.2	5.9	3.5	"		

STAGE 6
LOAD 1/2
BAROMETER 29.090 " Hg.

105.05	.052	—	1020	1020	—	74.34	.051	—	3600	252	106	76	43.0	28.0	17.0	9.7	5.2	2.1
105.56	.060	—	1138	"	—	74.65	.060	—	3620	251	110	75	42.0	28.0	16.5	9.0	4.8	1.9
106.00	.068	—	1253	"	—	74.88	.070	—	3600	249	118	75	42.0	28.0	16.2	9.0	4.8	2.0
106.47	.074	—	1370	"	—	75.18	.077	—	3600	252	124	75	42.5	28.0	17.0	9.5	5.2	2.0
106.95	.076	—	1484	"	—	75.48	.070	—	3600	257	130	75	42.0	27.5	16.3	9.0	4.8	2.0
107.42	.085	—	1606	"	—	75.81	.084	—	3625	260	130	74	42.0	27.4	16.3	9.0	4.8	2.0
107.87	.080	—	1715	"	.23	76.15	.100	—	3600	260	130	74	42.0	27.4	16.4	9.0	4.8	2.0

STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM IN THE DIFFERENT STAGES OF THE KERR TURBINE

STAGE 6
LOAD $\frac{3}{4}$

BAROMETER 29.078 "Hg.

CALORIMETER #1		STEAM		TRAP #2		CALORIMETER #3			R.P.M.	TEMP IN MAIN CAL. °F	PRESSURES # GAUGE							
STEAM CONDENSED IN CONDENSER LB	WATER DRAINED LB	CONDENSED LB	TARE LB	WATER DRAINED LB	STEAM CONDENSED LB	GAUGE READING LB	WATER DRAINED LB	IN MAIN			BELOW THROTTLE	1	2	3	4	5	6	
107.36	.025	—	507	507	—	75.69	.021	—	3575	267	125	95	53.5	35.0	21.6	11.6	6.0	2.0
107.85	.029	—	655	..	—	75.95	.026	—	3600	268	129	94	54.0	35.0	21.5	11.5	"	2.0
108.26	.034	—	789	"	—	76.23	.028	—	3600	267	130	93	54.0	35.0	21.8	11.6	"	2.0
108.70	.038	—	945	"	—	76.50	.033	—	3600	269	130	92	53.5	35.0	21.0	11.5	"	1.9
109.13	.045	—	1060	"	—	76.73	.046	—	3600	272	122	93	53.5	35.2	21.6	11.6	"	2.0
109.59	.067	—	1205	..	—	77.00	.057	—	3600	270	117	93	53.8	35.5	21.6	11.8	"	2.0
110.03	.073	—	1345	..	.20	77.26	.076	—	3600	268	118	94	54.0	35.8	21.9	11.8	"	2.0

STAGE 6

LOAD FULL

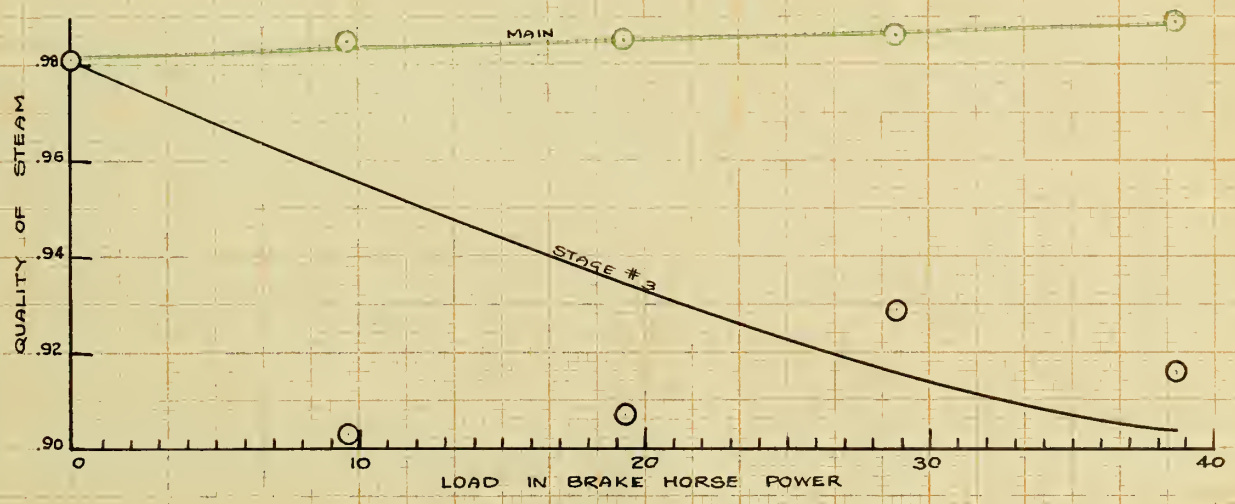
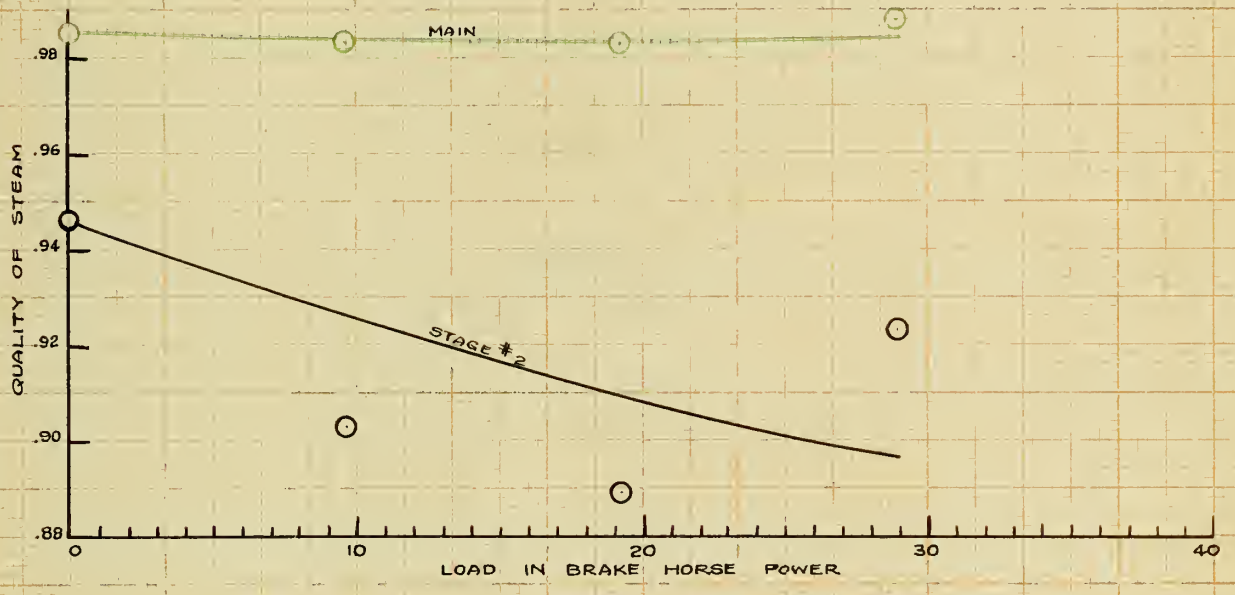
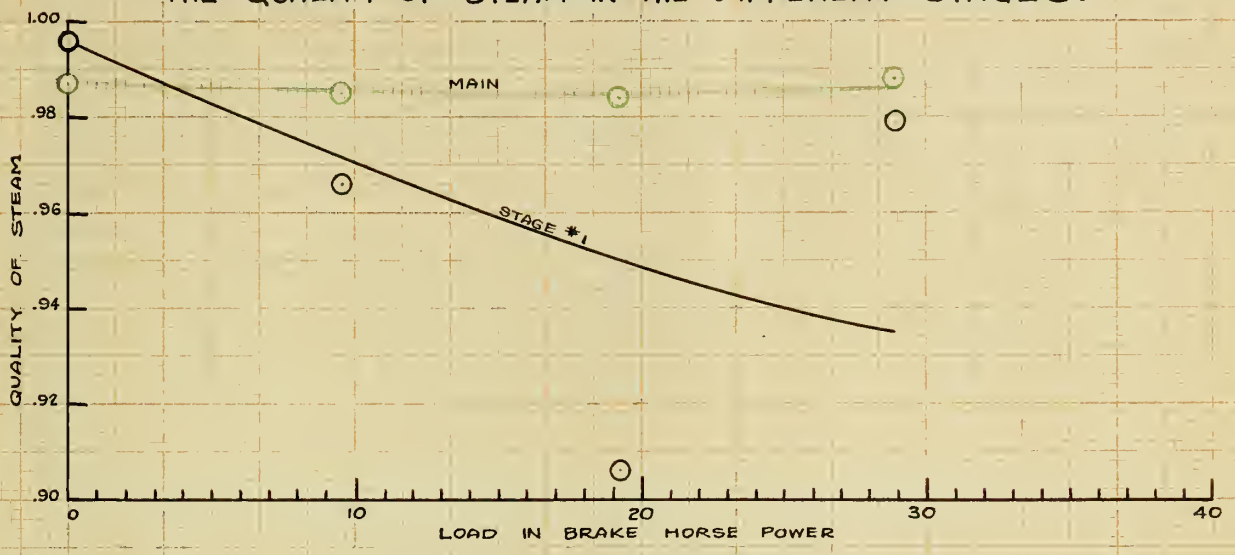
BAROMETER 29.070 "Hg.

100.71	.025	—	597	597	—	75.16	.023	—	3600	275	134	114	66.0	44.5	27.3	14.8	7.9	2.1
101.14	.029	—	758	"	—	75.30	.029	—	"	274	138	113	66.0	44.0	27.0	14.8	8.0	2.1
101.68	.034	—	943	"	—	75.60	.035	—	"	274	138	113	67.0	45.0	28.0	15.0	8.0	2.1
102.16	.048	—	1093	"	—	75.87	.039	—	"	280	128	114	65.0	43.5	27.0	14.5	7.6	2.0
102.62	.050	—	1259	"	—	76.12	.049	—	"	277	127	113	66.0	44.0	27.0	14.8	7.7	2.0
103.13	.058	—	1427	"	—	76.42	.062	—	"	272	136	114	66.0	44.4	27.5	14.9	7.8	2.0
103.61	.062	—	1589	"	.18	76.67	.071	—	"	279	134	113	66.0	44.2	27.5	14.8	7.7	2.0

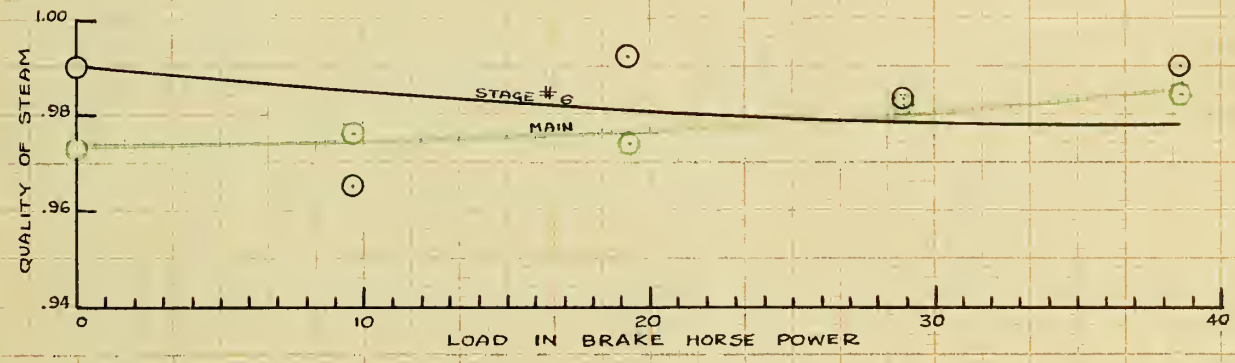
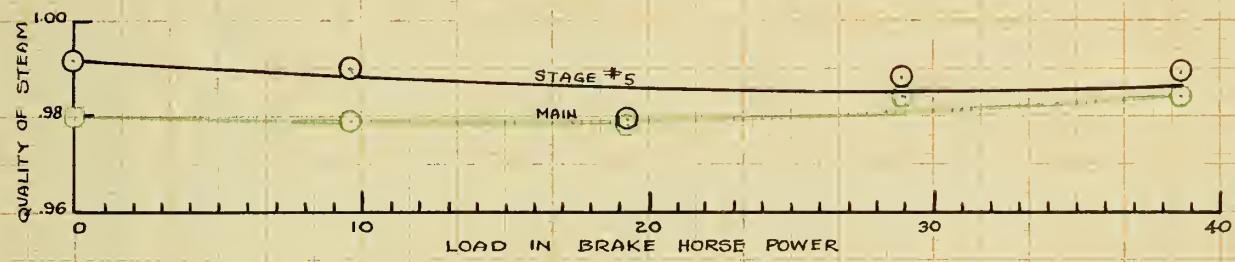
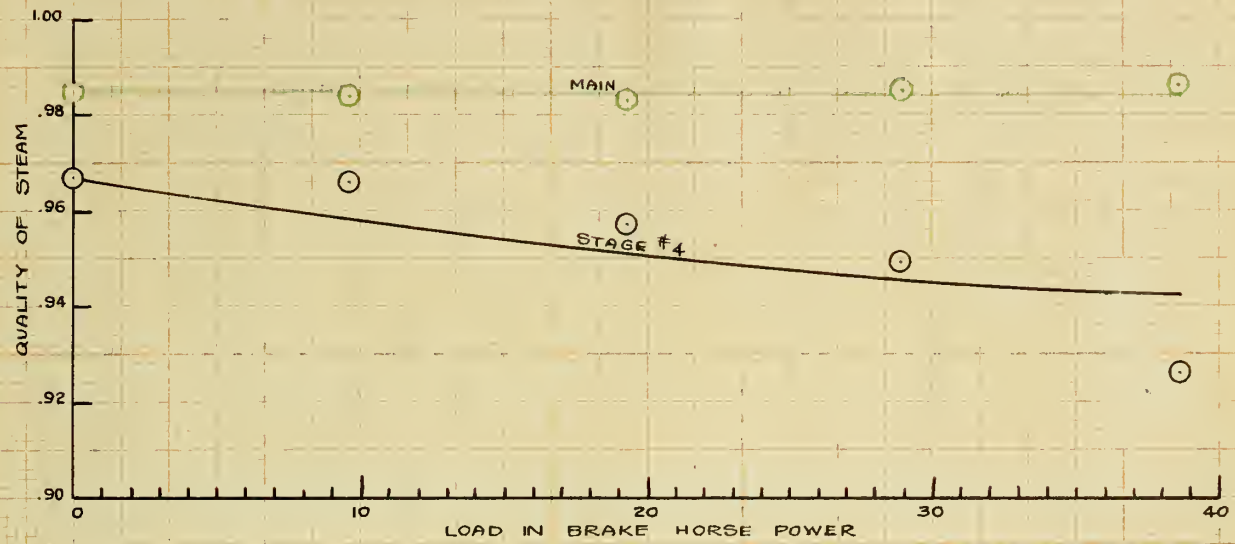
STUDY IN THE VARIATION IN THE QUALITY OF THE STEAM
 IN THE DIFFERENT STAGES OF THE KERR TURBINE.
 RESULT SHEET # 2.

N ^o	NOTATION	PRELIMINARY TESTS					STAGE # 4					STAGE # 5					STAGE # 6									
		0	1/4	1/2	3/4	FULL	0	1/4	1/2	3/4	FULL	0	1/4	1/2	3/4	FULL	0	1/4	1/2	3/4	FULL					
1	LOAD																									
2	LOAD IN B.H.P.	0.0	9.6	19.27	28.9	38.6	0.0	9.6	19.27	28.9	38.6	0.0	9.6	19.27	28.9	38.6	0.0	9.62	19.29	28.87	38.6	0.0	9.62	19.29	28.87	38.6
3	CAL#1. WEIGHT OF CONDENSED STEAM. LB	—	—	—	—	—	3.30	3.81	3.52	4.88	5.53	2.77	3.18	3.59	3.86	3.33	2.76	2.69	2.82	2.67	2.90	0.15	0.52	0.28	0.48	0.37
4	" WEIGHT OF SEPARATED WATER LB	—	—	—	—	—	0.22	0.33	0.55	1.08	1.84	0.1	0.24	0.34	0.38	0.26	—	—	—	—	—	—	—	—	—	—
5	" WEIGHT OF SEPARATED WATER LB BY WEIGHING	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	CAL#2. WEIGHT OF CONDENSED STEAM LB	—	—	—	—	—	0.61	0.78	0.95	1.26	1.46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	" WEIGHT OF SEPARATED WATER LB	—	—	—	—	—	0.05	0.056	0.075	0.124	0.23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	" WEIGHT OF SEPARATED WATER LB BY WEIGHING	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	CAL#3. WEIGHT OF CONDENSED STEAM LB	—	—	—	—	—	2.33	2.75	3.04	3.56	4.07	1.67	2.05	2.53	2.74	3.23	1.65	1.61	1.81	1.57	1.51	0.27	0.27	0.49	0.55	0.48
10	" WEIGHT OF SEPARATED WATER LB	—	—	—	—	—	0.41	0.75	1.24	1.64	2.41	0.24	0.23	0.84	0.47	0.72	—	—	—	—	—	—	—	—	—	—
11	" WEIGHT OF SEPARATED WATER LB BY WEIGHING	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	WEIGHT OF EXHAUST STEAM. LB	—	—	—	—	—	—	—	—	—	—	36.2	47.9	67.0	85.4	97.7	37.7	48.8	69.5	83.8	99.2	—	—	—	—	—
13	WEIGHT OF WATER TO TRAP. LB	—	—	—	—	—	—	—	—	—	—	0.22	0.27	0.45	0.34	0.37	0.096	0.122	0.202	0.17	0.157	—	—	—	—	—
14	PRESSURE IN MAIN. # GAUGE.	—	—	—	—	—	137.5	132.1	134.8	123.4	130.86	120.86	126.5	130.85	133.3	125.43	120.5	125.43	121.14	124.4	133.6	—	—	—	—	—
15	" BELOW THROTTLE "	30.943	52.3	70	93.4	114.3	36.6	52.4	73.14	95.0	114.4	37.3	53.0	74.7	95.6	117.3	40.0	52.0	74.85	93.4	113.43	—	—	—	—	—
16	" IN FIRST STAGE "	16.686	17.26	40.93	54.07	67.0	18.87	27.46	41.46	53.93	66.13	19.3	27.93	42.07	54.7	67.64	20.97	27.0	42.2	53.75	66.0	—	—	—	—	—
17	" " SECOND " "	10.0	17.64	26.886	35.37	45.2	12.14	18.2	27.88	36.47	44.6	12.13	18.0	27.87	36.3	45.7	12.92	17.34	27.0	35.2	44.23	—	—	—	—	—
18	" " THIRD " "	6.14	10.7	16.0	21.986	28.0	68.6	10.71	16.31	21.7	27.36	7.3	10.91	16.45	22.01	28.0	8.06	10.41	16.5	21.6	27.33	—	—	—	—	—
19	" " FOURTH " "	3.83	6.086	8.93	11.814	15.0	3.79	5.98	8.96	11.55	14.64	4.43	6.4	9.16	12.0	15.13	4.57	5.97	9.17	11.63	14.8	—	—	—	—	—
20	" " FIFTH " "	2.99	3.686	4.73	6.0	8.0	2.44	3.57	4.69	5.66	7.41	3.0	3.7	4.7	6.0	8.0	3.27	3.6	4.91	6.0	7.81	—	—	—	—	—
21	" " SIXTH " "	2.04	2.0	2.01	1.9	2.0	0.9	1.86	2.0	1.33	1.88	1.8	2.18	2.1	2.0	2.18	2.06	2.0	2.0	1.98	2.04	—	—	—	—	—
22	BAROMETER READING. INCHES Hg	—	—	—	—	—	29.154	29.056	29.05	29.074	29.038	29.157	29.252	29.232	29.204	29.278	29.147	29.136	29.009	29.078	29.070	—	—	—	—	—
23	TEMPERATURE IN MAIN CALORIMETER °F	—	—	—	—	—	277.8	272.88	273.96	274	280.1	261.3	263.0	263.0	273.1	277.1	252	256.6	254.4	268.7	276	—	—	—	—	—
24	REV. PER. MIN.	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3612	3611	3606	3597	3600	—	—	—	—	—
25	LENGTH OF BRAKE ARM IN FEET	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	—	—	—	—	—
26	WEIGHT ON BRAKE SCALE - TARE LB	0.0	5.6	11.25	16.87	22.5	0.0	5.6	11.25	16.87	22.5	0.0	5.6	11.25	16.87	22.5	0.0	5.6	11.25	16.87	22.5	—	—	—	—	—
27	TARE WEIGHT ON BRAKE SCALES LB	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	—	—	—	—	—
28	QUALITY OF STEAM IN CAL#1 = X ₁	—	—	—	—	—	0.994	0.992	0.985	0.980	0.968	0.997	0.992	0.990	0.992	0.998	0.995	0.9435	0.990	0.978	0.989	—	—	—	—	—
29	" " " #2 = X ₂	—	—	—	—	—	0.925	0.934	0.927	0.911	0.865	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	" " " #3 = X ₃	—	—	—	—	—	0.983	0.974	0.960	0.955	0.945	0.987	0.990	0.969	0.984	0.980	0.985	0.985	0.975	0.967	0.971	—	—	—	—	—
31	MEAN QUALITY IN STAGE	—	—	—	—	—	0.967	0.966	0.957	0.949	0.926	0.992	0.990	0.979	0.988	0.980	0.990	0.965	0.982	0.973	0.980	—	—	—	—	—
32	QUALITY IN MAIN.	—	—	—	—	—	0.985	0.984	0.983	0.985	0.986	0.980	0.979	0.978	0.984	0.984	0.973	0.976	0.974	0.982	0.984	—	—	—	—	—

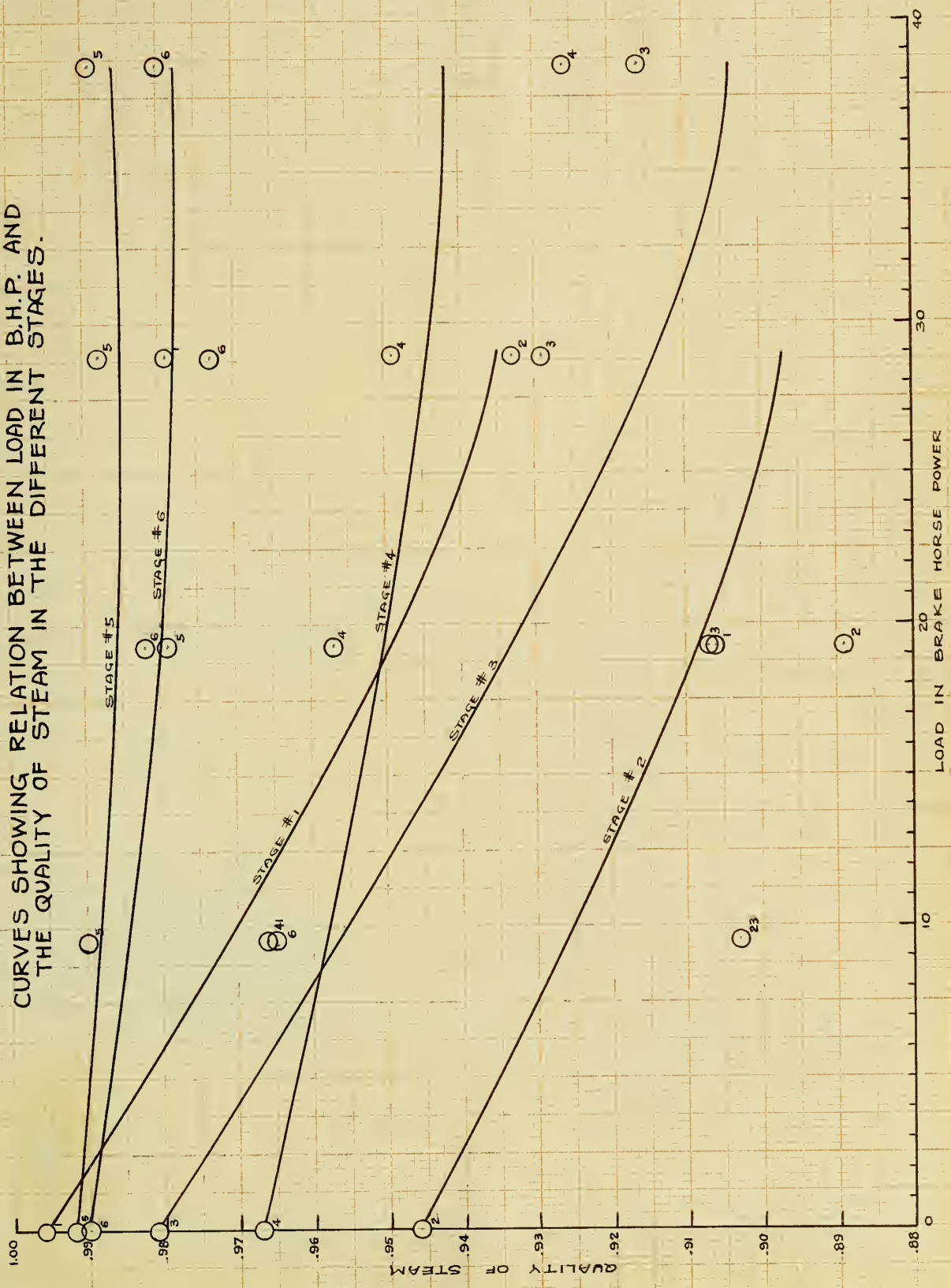
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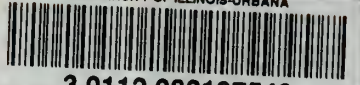
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